



FLOW MEASUREMENT ON A NATURAL GAS TRANSPORT PIPELINE



Oil & Gas / Downstream

“The fast channel switching of the FLUXUS® G722 enables us to reliably and accurately record the transported gas quantities even under highly dynamic conditions. We developed this impressive solution for our challenging measurement task in excellent cooperation with the measurement experts from Flexim.”



*Christoph Wülser,
Electric & Instrumentation,
Transitgas AG.*



Measuring Task

Flow measurement of natural gas on the 48” transport pipeline of Transitgas AG under difficult flow conditions in the Obergesteln tunnel near Obergesteln (Valais, Switzerland)

The Transitgas pipeline is the Swiss section of the high-pressure natural gas pipeline that connects the gas fields of Northern Europe with Italy. The current pipeline system consists of 82 miles of 48” lines and 100 miles of 36” lines. It crosses the Swiss Plateau and the Alps from north to south, connecting to the French natural gas network in the west.

Two 36” parallel pipelines from Germany cross under the Rhine and terminate in the pig reception station of the Wallbach metering station. The quantity and quality of the gas that reaches Switzerland from Germany are determined at this station. The corresponding transfer station to and from the French natural gas network is in Oltingue (F). The operations center of the Swiss transport system is the Ruswil compressor station near Lucerne. From here, the necessary transport pressure is maintained and the entire gas pipeline is monitored and controlled. South of the Ruswil compressor station, the 48” line crosses the Alps, i.e. the three mountain ridges Brienzer Rothorn, Grimsel, and Grieshorn had to be conquered. This was only feasible thanks to tunnels built. At the Gries Pass, the natural gas pipeline reaches

Italian territory in a tunnel at an altitude of 7,900 ft. The transfer station is on the Italian side in Masera near Domodossola.

Since 2017, the Transitgas system has been physically capable of transporting quantities in the so-called reverse flow from Gries-Pass/Italy to Switzerland, Germany, and France. In 2018, the Obergesteln gate valve station at the entrance to the Obergesteln tunnel was expanded into a control station. The control station helps Transitgas to control the flow of gas to and from Italy in terms of quantity and pressure. However, in order to regulate the quantity, it is necessary to know the gas quantities currently flowing through, i.e. they must be recorded by measurement.



Solution

Retrofitting this artery of European natural gas supply with a flowmeter is no trivial task. Any interruption of the natural gas transport to install a wetted gas meter should of course be avoided at all costs.

When it comes to installing a flowmeter on an existing pipe system, Flexim's clamp-on ultrasonic measurement technology has always been recommended. As a pioneer in the field of non-intrusive gas flow measurement, Flexim has instrumented countless flow measurement points along the entire natural gas value chain – from the production well to the municipal distribution network – and has earned an excellent reputation in the industry. Flexim, therefore, received the order to fit the 48" transport line with a flowmeter.

Of course, setting up such a measuring point is not an everyday routine task, even for the flow measurement experts at Flexim. After all, non-intrusive measurement technology offers the possibility of empirically determining the most suitable type of transducer and the most appropriate setup of the measurement on-site in test measurements without any impairment of the availability of the pipeline. The special challenges in measuring the gas flow in the Obergesteln tunnel are not only the impressive dimensions of the pipeline but also the possible high flow velocities and the flow profile disturbed by a slight bend (swan neck).

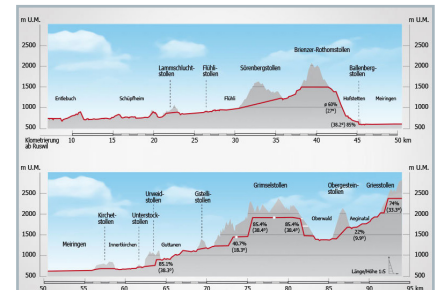
Due to the enormous pipe diameter and the possible high flow velocities, it is advisable to set up the measurement in the transmission mode. However, this sturdy transducer arrangement is to the detriment of measurement accuracy: While distortions in the flow profile are more or less automatically compensated for in reflex mode, cross-flows have a strong effect on the measurement result in transmission mode. This effect can in turn be well compensated for by the two-channel structure of the measurement with two pairs of transducers, which are arranged as an X in one plane. In the tests, low-frequency Lamb wave GRG transducers turned out to be the most suitable. The explosion-proof dual channel device FLUXUS® G809 was chosen as the transmitter.

During operation, it turned out that the channel switching of the FLUXUS® G809 was not always up to the highly dynamic flow conditions. Flexim, therefore, suggested replacing the transmitter with the more modern FLUXUS® G722. The FLUXUS® G722 has a high-performance processor that



The Transitgas transport system consists of 292 km of natural gas pipeline with several tunnels, a compressor station with waste heat recovery systems, a measuring station, and various valve stations.

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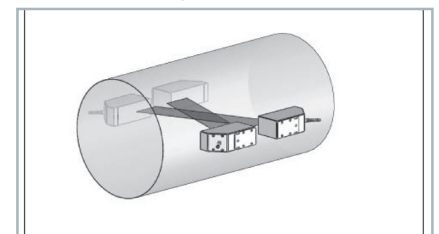


Crossing the Alps required the construction of 14 accessible tunnels with a total length of 37.4 km.

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First, test measurements were carried out in order to determine the most suitable transducer type and the most appropriate transducer arrangement.



Cross-flow effects can be easily compensated for by constructing the measurement with two pairs of transducers, each of which radiates through the pipe in an X-arrangement with a sound path in one plane.

enables fast channel switching between its two independent measurement channels.

In the event of strong flow profile disturbances and turbulence, the high-performance processor enables the fast simultaneous recording and processing of measurement data from the two independent measurement channels A and B and the output of an average value via the calculation channel Y. This effectively reduces cross-flow effects and better maps the actual flow profile.

With the FLUXUS® G722, Transitgas now has a highly dynamic flow measurement for controlling the gas volume at the Obergesteln valve station. As a

principle, ultrasonic flow measurement is bidirectional, i.e. FLUXUS® measures independently of the flow direction with the same high level of accuracy and dynamics. Therefore, the quantities of gas that flow in reverse flow from south to north are also reliably and accurately recorded.



The finished installation with the clamp-on ultrasonic transducers attached to the Variofix C mounting rails (the corresponding counterparts on the other side of the pipe are not visible in the picture).



The FLUXUS® G809 was originally intended as the transmitter. Its channel switching proved to be too slow in some operating situations.



Now a FLUXUS® G722 is used. The synchronous two-channel measurement of the FLUXUS® G722 effectively compensates for the flow profile disturbance. Instead of being installed directly next to the transducers, the transmitter was now installed in a technical room in the tunnel.



Advantages

- Reliable and accurate non-intrusive recording of gas quantities
- Retrofit without interrupting gas transport
- Synchronous multi-channel measurement for effective compensation of the disturbed flow profile
- Bidirectional measurement reliably and accurately records gas quantities in reverse flow
- Excellent cooperation with Flexim's international technical support team

Measuring Points and Instrumentation

Pipeline	steel,(48"), pipe wall thickness 0.83" outer sheathing (corrosion protection) o.16" PE
Medium	natural gas, pressure 700-1,100 psi
1 stationary clamp-on FLUXUS® G722 ultrasonic system (two measuring channels, fast channel switching)	
2 pairs of clamp-on GRG1N83 ultrasonic transducers (Lamb wave) for gases, mounted in single-path diagonal arrangement in VARIOFIX C	

Customer

Transitgas AG, Valve and Regulation Station Obergesteln, Switzerland

The company purpose of Transitgas AG, founded in 1971 and based in Zurich, is the construction, maintenance, and operation of a natural gas transport system that stretches from the northern to the southern border of Switzerland. This infrastructure secures Switzerland's natural gas supply and European integration for gas transport.

The transport capacities of the Transitgas system are distributed over the long term to the two shareholders, Swissgas AG and FluxSwiss sagl. The two shareholders market and manage the transport capacities of around 18 billion standard cubic meters from Wallbach/Germany and around 8 billion standard cubic meters from Oltingue/France. Since 2017, transport capacities of approx. 13 billion standard cubic meters have been available in the so-called reverse flow from Gries Pass/Italy to Switzerland, Germany, and France. The south-north flows now encourage liquidity between trading venues in all directions.



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